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Description

The invention relates to an apparatus for processing video signals, containing a teletext processing device comprising:

- a separation device for separating teletext data from a received video signal,

- a signal generating device for generating signals which can be displayed on a screen for displaying characters contained in the teletext data,

- a non-volatile memory, in which characters which can be displayed on a screen are stored,

- a controller supplying the characters contained in the non-volatile memory to the signal generating device for display on the screen.

Apparatus for processing video signals containing a teletext processing device, such as television sets, is known. With the teletext service, digital data is transmitted at the transmitter-side in the vertical blanking interval. At the receiver-side the teletext data is prepared in a teletext processor for display on a screen. The data transmitted by the transmitter contains characters from a predetermined set of characters. A digital value is conventionally transmitted for a character that can be displayed. At the transmitter-side there is a non-volatile read only memory (ROM) containing the pixel information for each character to be displayed. A controller allocates the transmitted digital data value to the characters which can be displayed stored in the ROM. A display generator generates signals with which the screen can be controlled.

While, for example Latin, Arabic or Cyrillic characters comprise a manageable number of characters, other languages' sets of characters, for example those of some Asian countries, can comprise several thousand characters. For example a standard set of Chinese characters comprises more than 7,600 characters, which, with a resolution of 24 x 30 pixels, would require a memory capacity of about 5.5 Mbit.

The object of the invention is to improve the apparatus mentioned at the outset such that the memory requirement for the set of characters of the characters which can be displayed is as low as possible.

According to the invention this is achieved in that the characters contained in the non-volatile memory are stored with redundance-reducing coding and the controller is constructed such that the characters contained in the non-volatile memory are decoded when read out.

In a teletext processor according to the invention the memory requirement for the characters which can be displayed is reduced by the compression rate of the redundance-reducing code. Decoding is expediently carried out when reading out individual characters from the character set memory. This can be carried out, for example, by a correspondingly programmed microprocessor contained in the teletext processing device. Alternatively it would be conceivable to carry out the decompression rule using a corresponding hardware device connected downstream of the character set memory at the output-side.

In a preferred embodiment of the invention a writeable memory is additionally provided, in which a teletext page to be displayed on the screen is composed pixel-wise. If the page is displayed field-wise by interlacing, the pixels of two fields are buffered in the frame memory. In addition to the pixel information, further display attributes can also be stored for

each character, such as background and foreground colours. This has the advantage that a screen page to be displayed is only composed once and then is repeatedly read out from the memory at the field reproduction frequency. Decompression of the characters to be displayed is less time critical here than without a buffer. It can, for example, be carried out by a microprocessor core already contained in the teletext processor for other purposes. This is programmed with corresponding software for this purpose. The processing rate for composing the page in the buffer can generally be carried out by the microprocessor core so quickly that the viewer does not notice any delay during display build-up.

A large number of methods are known for coding and decoding information. In principle, any decompression method can be carried out in the apparatus according to the invention. However, in an advantageous configuration of the invention the teletext processing device is constructed such that compressed storage of the characters and corresponding decompressing decoding thereof is adapted to characters, in particular Chinese characters. For this purpose, each character is divided into a number of partial character segments. It has been found that the same partial characters are used in a large number of characters. These are stored only once in the memory, their memory address being referred to via a pointer. The corresponding pointers and the pixel information characteristic of the respective character are used for storing a character. A character spacing in the vertical direction can be generated by blank lines and does not have to be stored in the set of characters. The blank characters are expediently written into the buffer together with the character. The memory capacity required for storing the entire set of characters can thus be substantially reduced. Integration of a teletext processor as a single integrated circuit is then readily possible with current production technologies.

The invention and further advantageous configurations will be described in more detail hereinafter with reference to figures shown in the drawings, in which:

Fig. 1 shows a television set with a teletext processor,

Fig. 2 shows a character with various character segments,

Fig. 3 shows the memory occupancy of the non-volatile memory for storing the characters which can be displayed.

An apparatus according to the invention can, for example, as shown in Fig. 1, be designed as a television set. The television set receives a television signal via an antenna 101. The frequency band of the adjusted transmitter is selected in a tuner 102 and the video signal corresponding to the adjusted transmitter is converted to the intermediate frequency position and demodulated in an intermediate frequency and demodulation stage 103. At the output to the device 103 the video signal FBAS exists in the base band. Colour and brightness signals are generated from the video signal FBAS in an image processing device 104 to control a picture tube 106. Horizontal and vertical pulses are generated from the video signal FBAS in a device 105 to deflect the electron beam of the picture tube 106. A device 107 is used to process the teletext signals. The video signal FBAS is supplied digitised to the device 107 via an analogue-to-digital converter 110. The device 107 generates output signals RGB to control the picture tube 106.

At the input for the video signal FBAS, the teletext processing device 107 comprises an acquisition device 112. The teletext data contained in the video signal is separated by the acquisition device 112 and prepared accordingly for intermediate storage and further processing in the device 107. A controller 111 provides for sequence control and data control in the teletext processor 107. The controller 111 is

expediently a software-controlled microprocessor core. The device 107 comprises a working memory (not shown) for programme control and intermediate data storage. At the output-side the teletext processor 107 contains a device 113 for generating the RGB signals as a function of the teletext information to be displayed.

The set of characters which can be displayed on the screen is stored in a non-volatile memory 115. The controller 111 ensures that the display generator 113 is supplied with the pixel information provided by the memory 115 for the teletext data to be displayed. According to the invention it is provided that the characters contained in the memory 115 are stored coded, the quantity of data to be stored being compressed. For this purpose, a redundance-reducing code is used. When reading out the characters from the memory 115, the stored character information is decoded and decompressed in the process. A teletext page to be displayed on the screen is compiled in a writeable volatile memory 114 (RAM). The pixel information and character attributes, for example foreground and background colour, flashing, etc. required for generating the RGB signal by the display generator 113 are provided for each character. The information stored in the display memory 114 is continuously read by the display generator 113 to generate the RGB signals. The display memory 114 contains the information of two fields. The display memory 114 contains the pixel information for a teletext page to be displayed on the screen. For example it contains 25 lines, according to conventional teletext standards, each of which comprises 40 characters. Owing to the fact that a teletext page is initially assembled in the display memory 114 before display on the screen, there is sufficient time for character decompression by the controller 111. The display memory 114 only has to be rewritten to in the event of a change in information. The decompression method can consequently be programmed in software and carried out by a conventional microprocessor core 111. The quantity of data to be stored in

the memory 115 is different for each character as a result of data compression. In one software implementation the memory address of a character can, for example, be simply achieved in the form of look-up tables. No delay during frame build-up can be detected by a viewer with the quantities of data which can be processed in this way nowadays.

A range of known compression rules (and accordingly decompression rules) can, in principle, be used for data compression. Conventional rules, such as Huffmann coding, run-length coding or arithmetic coding are, however, optimised to carry out data compression and data decompression in the shortest time possible. However, in the present case, data compression is not necessary at the receiver-side. The data structure in the character set memory 115 described hereinafter is particularly suitable for quick data decompression for characters.

The standard Chinese set of characters GB 5007 contains 7,632 characters, which each have to be displayed with a resolution of 24 x 30 pixels. This amounts to a quantity of information of about 5.5 Mbit. The physical distribution of such a character is shown in Fig. 2. The first three pixel lines 0, 1, 2 and the last three pixel lines 27, 28, 29 are blank lines. Consequently these do not need to be stored and are pasted into the display memory 114 in the controller 111 during pixel-wise compiling of the teletext page to be displayed. The width of a character is 24 pixels. The remaining portion of a character is divided into 18 character segments 40...57, preferably of equal size. One character segment then has a size of 4 x 8 pixels. It is then found that some of these character segments are provided in various characters. Other character segments are characteristic of the respective characters.

With this distribution of a character into character segments the data can be stored in the memory 114 of Fig. 3 as follows.

The memory contains a first memory sector 119, in which the individual data pertaining to a respective character 120, 121 is stored. The character segments, common to various characters, the general character segments 125, 126, 127, are stored in another memory sector 118. When storing the individual character information 120, 121 corresponding pointers are provided, referring to the memory address of the respective general character segments 125...127 contained in the character. The data pertaining to a character is compiled for pixel information when read out from the memory.

The right-hand portion of Fig. 3 shows an exemplary organisation of the data associated with one character 120, 121. A data record of this type describing one character contains a header line 130, in which one bit is provided for each character segment 40...57. This bit establishes whether the character segment associated therewith is a general character segment stored in the memory block 118 or whether the respective character segment is stored directly in the character data record 120, 121. The header line 130 consequently comprises 18 bits. For the general character segments displayed according to the header line 130, the character data record also contains a respective pointer referring to the memory address of the general character in the memory sector 118. In the present case there are three pointers 131, 132, 133 referring to the respective memory addresses of the general character segments 125, 126, 127. The sequence of pointers corresponds to the respective sequence of the occurrence of the corresponding general character segments in the character. The pixel data for the character segments 134, 135 which do not exist as general character segments but have to be stored individually for each individual character, are then stored subsequent to the last of the pointers.

The header line is evaluated first by the controller 111 to read out the characters from the memory 115. The header line indicates whether the pixel data stored for the character

segments 40...57 is contained successively in this data record or whether there is a general character segment stored in a separate sector 118 of the memory to which reference is made via pointers. During the further retrieval process for the character, the general character segments are read out according to the pointers. The character segments individual to the character are then read out. The character is then compiled in the display memory 114.

To keep the pointer length as short as possible and therefore to further reduce the storage location requirement, it is expedient to provide the general character segments with a consecutive number. The pointers 131, 132, 133 then contain the respective number of the general character segment. This number is then converted into the corresponding memory address by the controller 111. This can be carried out, for example, in that the general character segments each take up a strictly predetermined memory location amount, so multiplication of general character segment number and memory location amount and an addition of a start address is sufficient to calculate the respective memory address. On the other hand, the conversion could be carried out via a look-up table.

The characters 120, 121 stored by means of the above-described redundance-reducing code have a different storage location requirement. Addressing of the individual characters can be taken into account in the controller 111 by corresponding programming, for example in the form of a look-up table. On the other hand, the memory could be accessed via a corresponding hardware-assisted implementation in the memory addressing. The address of each character or only a certain selection of characters, for example every eighth character, can be stored in the look-up table. In the latter case the character preceding the character to be read out then has to be accessed via the table to arrive at the character to be read out by evaluating at least the header line of each successively stored character.

Claims

1. Apparatus for processing video signals, containing a teletext processing device (107) comprising:

- a separation device (112) for separating teletext data from a received video signal (FBAS),

- a signal generating device (113) for generating signals which can be displayed on a screen (106) for displaying characters contained in the teletext data,

- a non-volatile memory (115), in which characters which can be displayed on a screen are stored,

- a controller (111) supplying the characters contained in the non-volatile memory (115) to the signal generating device (113) for display on the screen,

characterised in that

- the characters contained in the non-volatile memory (115) are stored with redundance-reducing coding,

- the controller (111) is constructed such that the characters contained in the non-volatile memory (115) are decoded when read out.

2. Apparatus according to claim 1, characterised in that a writeable memory (114) is provided which is connected between the controller (111) and the signal generating device (113) and in which the characters for display on the screen are buffered in decoded form.

3. Apparatus according to claim 2, characterised in that the buffered characters for display on the screen are stored in the writeable memory (114) pixel-wise and screen-side-wise.

4. Apparatus according to any of claims 1 to 3, characterised in that the non-volatile memory (115) contains a large number of characters which can be displayed on the screen, in that a number of character segments (40 ... 57) is stored for each character, in that one character segment, contained in at least two characters (general character segment) is stored only once in the non-volatile memory (115), in that a pointer (131, 132, 133) referring to the memory location (125, 126, 127) of the general character segment is stored for the general character segment contained in a character which can be displayed, and in that the controller (111) is constructed such that a character to be read out from the non-volatile memory (115) for decoding is composed of the character segments and general character segments.

5. Apparatus according to claim 4, characterised in that the characters consist of pixels divided into lines and in that the controller (111) is constructed such that at least one blank line in the vertical direction is added to the character after being read out from the non-volatile memory (115).

6. Apparatus according to either of claims 4 or 5, characterised in that for at least one character which can be displayed, the non-volatile memory comprises a memory sector (120, 121) containing:

- for each of the character segments, an identification (130) as to whether the character segment is contained in the memory sector (120, 121) of the character which can be displayed or whether the character segment is a general character segment,

- a pointer (131, 132, 133) to the memory address (125, 126, 127) of the general character segment if one of the identifications (130) indicates that there is a general character segment,

- the pixel information (134, 135) for the character segments for which the respective identification (130) indicates that they are not general character segments.

7. Apparatus according to any of claims 4 to 6, characterised in that the general character segments are stored in a related manner, in that a consecutive number is associated with each general character segment, in that one of the pointers (131, 132, 133) for one of the general character segments incorporates the respective number associated therewith, and in that the memory address of the general character segment is ascertained by the controller (111) by evaluating the number.

8. Apparatus according to any of claims 1 to 7, characterised in that a tuner (102) is provided to which a signal received by an antenna (101) is supplied, an intermediate frequency stage (103) and a demodulator stage (103) are connected downstream thereof at the output side, which generates the video signal, and a screen (106) is controllable by the signal generating device (113).

2 pages of drawings follow